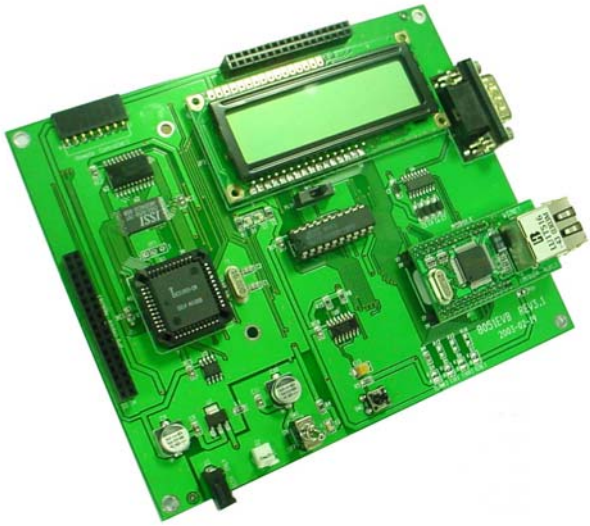
EVB8051 User's Manual

Version 3.1.1



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1. Getting Started

1.1 EVB8051 Package

1.1.1 Components

The EVB8051 is packaged as shown in <Fig. 1>, and its contents are as shown in <Fig. 2>.

<Fig. 1: EVB8051 Package>

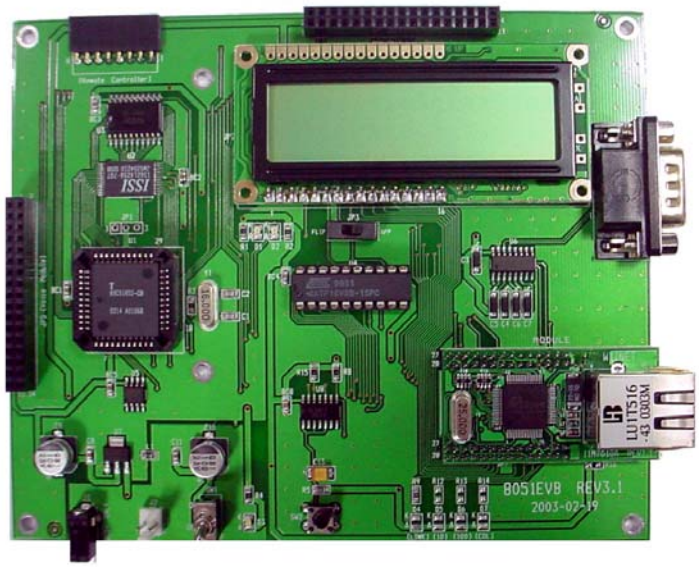
The EVB8051 contains the items described in the table below. Photographs of the items are shown in <Fig. 3> through <Fig. 11>.

<Table 1: List of Items Contained in the EVB8051>

No.	Item	Quantity
1	MB-EVB8051	1
2	NM7010A (Plugged in MB-EVB8051)	1
2	User's Manual	1
3	Power Adaptor (5V)	1
4	Software CD	1
5	UTP Cable	1
6	Serial Cable	1

<Fig. 2: Items contained in the EVB8051>

<Fig. 3> shows the EVB8051 Board. It includes a LCD that is useful for testing the functions of the web server and for debugging.

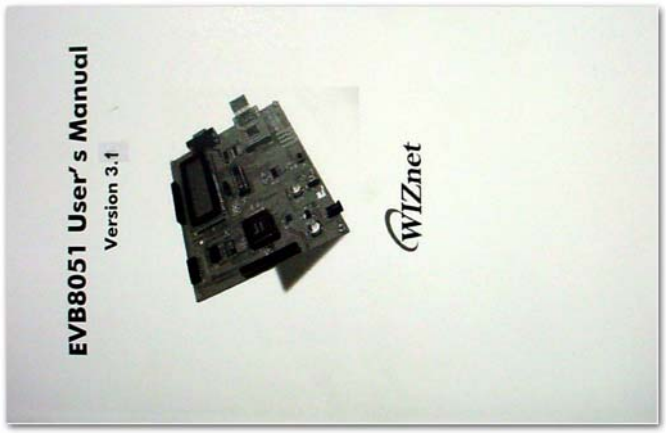


<Fig. 3: EVB8051>

<Fig. 4> shows a NM7010A plugged in the EVB8051. For more information, please refer to Appendix C. Specification of NM7010A.

<Fig. 4: NM7010A>

<Fig.5> shows the User's Manual of the EVB8051.



<Fig. 5: User's Manual>

<Fig. 6> shows the 5V Power Adaptor for supplying power to the EVB8051.

<Fig. 6: Power Adaptor (5V)>

<Fig. 7> shows the Software CD provided with the EVB8051. It contains Documents, Schematics, Source Code, and Software.

<Fig. 7: Software CD>

<Fig. 8> shows the UTP Cable (Crossed Cable) for connecting the EVB8051 directly to the PC.

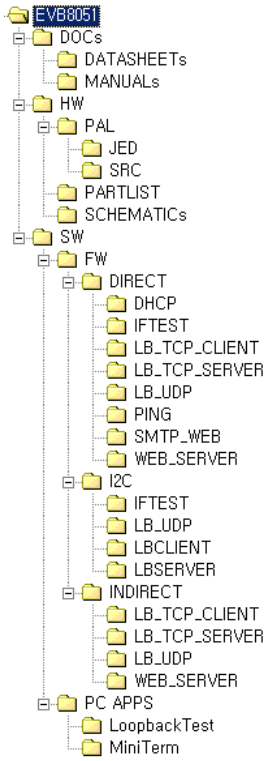
<Fig. 8: UTP Cable>

<Fig. 9> shows the Serial Cable (Female-to-Female) for connecting the EVB8051 to the PC. It is used for monitoring and program downloading. Please refer to Appendix B. Specification of serial cable.

<Fig. 9: Serial Cable>

1.1.2 Software CD

The EVB8051 is supplied with a Software CD that contains various development tools including Documents, Schematics, Source Codes, and PC Softwares. <Fig. 10> shows the directory structure of the Software CD.



<Fig. 10: Directory Structure of the Software CD>

1.1.2.1 Document

Contains the data sheets of essential parts, including the W3100A. User manual is also included.

1.1.2.2 Schematic

Contains the circuit diagram of the EVB8051. The PAL subdirectory contains the PAL Source that is necessary for interfacing the 8051 MCU and the W3100A.

1.1.2.3 Software

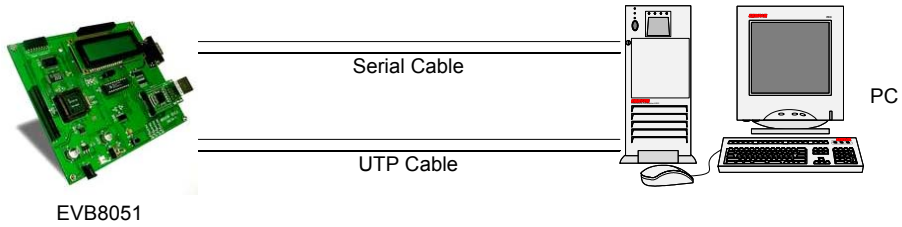
Software is provided for the Firmware and PC applications. The software for the Firmware contains the W3100A API Driver for the 8051 and some samples of application source code. The software for PC applications contains Loopback Test program and Serial Terminal program for Windows.

1.2 System Configuration

1.2.1 PC Setup

1.2.1.1 Connecting Cables

For testing the functions of the EVB8051 and for application development, the system should be configured as shown in <Fig. 11>. First, the EVB8051 is connected to the PC using the crossed UTP Cable (for data transmission) and the Serial Cable (for monitoring and for program downloading).



<Fig. 11: System Configuration between EVB8051 and PC>

1.2.1.2 Network Configuration

For convenience of development, the EVB8051 contains the following default network information:

- IP address: 192.168.0.2
- MAC address: 00-08-DC-00-00-00
- Gateway address: 192.168.0.1
- Subnet Mask: 255.255.255.0

The above information contained in the EVB8051 can be modified at any time to suit the developer's purpose.

First, for testing purposes, set the PC network information as follows:

- IP address: 192.168.0.5
- Gateway address: 192.168.0.1
- Subnet Mask: 255.255.255.0

After the above setup, confirm the operation of the EVB8051 on the PC using the Ping command.

```
C:\> ping 192.168.0.2 –t
```

If the connection has been set up properly, the following message will be displayed on the

screen:

Pinging 192.168.0.2 with 32 bytes of data:
Reply from 192.168.0.2: bytes=32 time<10ms TTL=128
Reply from 192.168.0.2: bytes=32 time<10ms TTL=128
Reply from 192.168.0.2: bytes=32 time<10ms TTL=128
:

If the connection has not been set up properly, the following message will be displayed on the screen:

Pinging 192.168.0.2 with 32 bytes of data:
Request timed out.

In this case, please refer to Troubleshooting Guide 2.3.1.

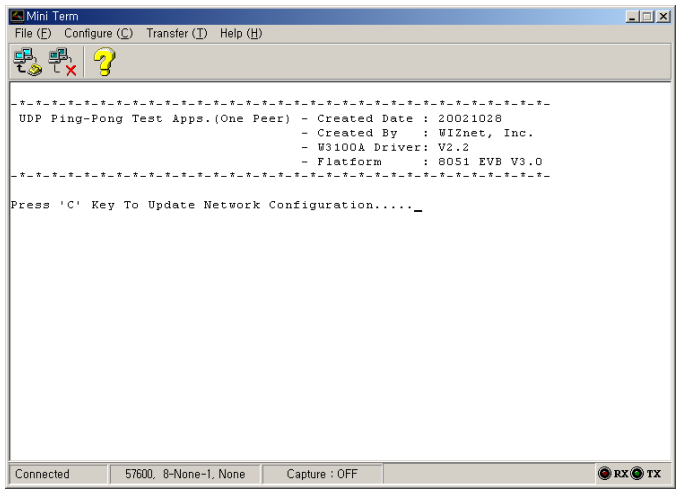
1.2.1.3 Changing network configuration of EVB8051.

When EVB8051 boots up, you can change the network configuration of EVB8051 by serial. After you configure your PC as shown in <Fig. 11>, Run MiniTerm Program on your PC.

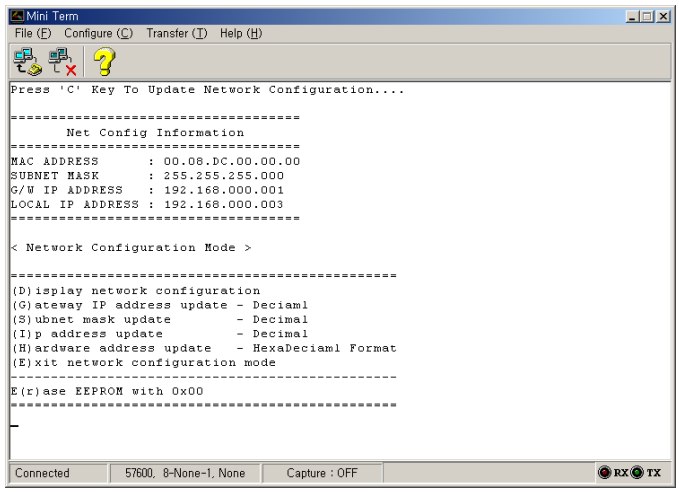
Set serial configuration with following values on PC.

Speed	57600
Parity	None
Data bit	8
Stop bit	1
Flow control	None

And reset EVB8051.
You can see the boot-up message as shown in <Fig. 12>.


Mini Term
File (F) Configure (C) Transfer (T) Help (H)
UDP Ping-Pong Test Apps.(One Peer) - Created Date : 20021028
- Created By : WIZnet, Inc.
- W3100A Driver: V2.2
- Flatform : 8051 EVB V3.0
Press 'C' Key To Update Network Configuration.....
Connected
57600, 8-None-1, None
Capture : OFF
RX TX

<Fig. 12: boot-up message of EVB8051>


Mini Term
File (F) Configure (C) Transfer (T) Help (H)
Press 'C' Key To Update Network Configuration....
Net Config Information
MAC ADDRESS : 00.08.DC.00.00.00
SUBNET MASK : 255.255.255.000
G/W IP ADDRESS : 192.168.000.001
LOCAL IP ADDRESS : 192.168.000.003
< Network Configuration Mode >
(D)isplay network configuration
(G)ateway IP address update - Deciaml
(S)ubnet mask update - Decimal
(I)p address update - Decimal
(H)ardware address update - HexaDeciaml Format
(E)xit network configuration mode
E(r)ase EEPROM with 0x00
Connected
57600, 8-None-1, None
Capture : OFF
RX TX

<Fig. 13: Network Configuration Menu>

And when you press ‘C’, you can see the menu as shown in <Fig. 13>.
The menu consists of the Command Set as shown in <Table 2>.

<Table 2: List of Command for Network Configuration for EVB8051>

Command	Meaning
D, d	Display network information
G, g	Set Default Gateway IP address
S, s	Set Subnet Mask
I, I	Set EVB IP address
H, h	Set EVB MAC address
E, e	Exit menu and run program

1.2.1.3 Program Installation

Since the EVB8051 uses an ATMEL 8051 MCU, you can use the development tools (In-System-Programmer) provided by ATMEL. To download the tools required for development, visit the ATMEL site and download the latest version of the FLIP Software for installation.

> [8051 – Architecture – Software]
> http://www.atmel.com/atmel/products/prod74.htm
> **FLIP Software** (Download dev_tools3bc6c0cebce3f.zip now. 1.9M, updated Apr 24, 2002)
> FLIP (Flexible In-system Programmer) software v1.6.0. Runs Windows 9x/Me/NT/2000/XP.
> Supports RS232 or CAN link.

* Note: Above information may differ, Please refer to recent information on it from ATMEL.

1.2.2 Evaluation Board Configuration

1.2.2.1 W3100A mode setting

The W3100A's mode has been fixed to CLOCKED mode as default.

1.2.2.2 PHY mode setting

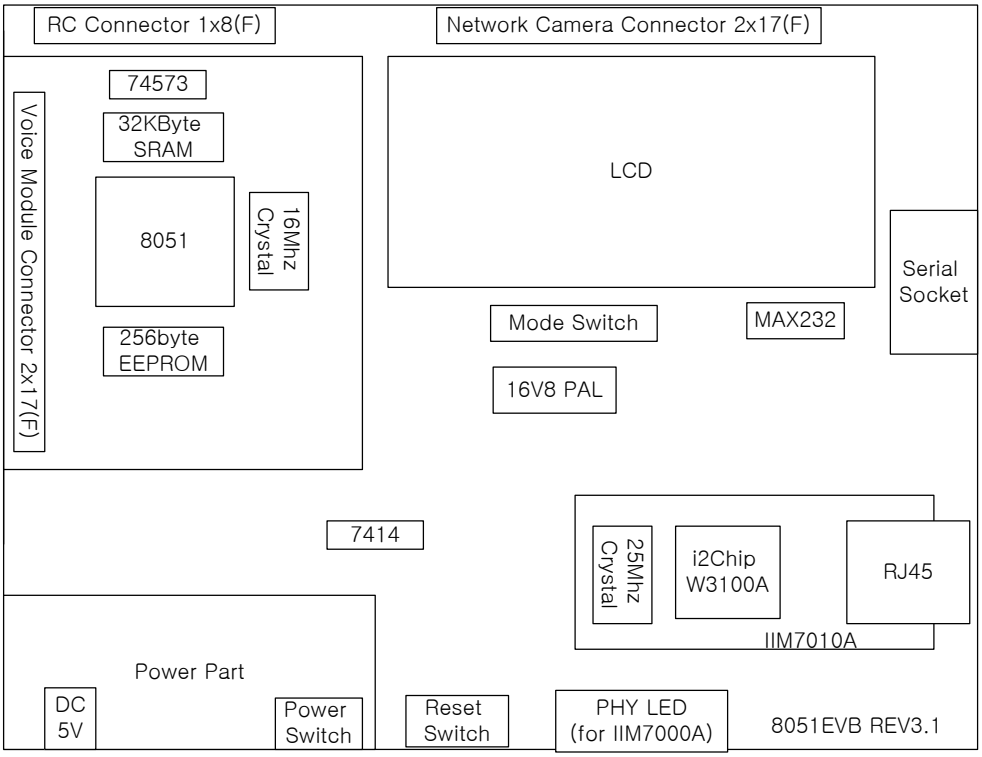
The PHY mode has been set as follows;

- Auto Negotiation: Yes
- Full Duplex: Yes
- Speed: 100Mbps

2. User's Guide

2.1 Evaluation Board Layout

<Fig. 14> illustrates the layout of the EVB8051 Board. On the upper left is the processor area that includes the 8051 MCU with 64 Kbytes of flash memory and 32 Kbytes of SRAM. On the upper right is TEXT LCD area. The power section is located on the bottom left, which accepts 5V and supplies 5V and 3.3V to the board. On the bottom right, NM7010A, that includes W3100A, PHY and MAC jack with transformer, is located.



<Fig. 14: Layout of EVB8051>

2.2 Function Testing

2.2.1 Loopback Test

The Loopback is the operational mode for measuring the transmission performance of the iinChip™ W3100A on the EVB8051. It is used for measuring data transfer speed when the EVB8051 board receives data from the PC and sends it back to the PC. And they are the sample code of TCP server mode and client mode.

2.2.1.1 Configuration

Since the EVB8051 board is equipped with default Loopback execution code (TCP Server) in the internal flash memory, its operation can be verified immediately after a network has been set up.

First, install the Axinstall.exe program (located in the "\Software\PC\LoopbackTest" folder on the CD) on the PC. Once the AxinstallVX.X.EXE is installed, the Ax1.exe program is created and is required by the PC for Loopback testing. To run the Loopback program loaded on the EVB8051, slide the JP3 Slide Switch on the board to the right.

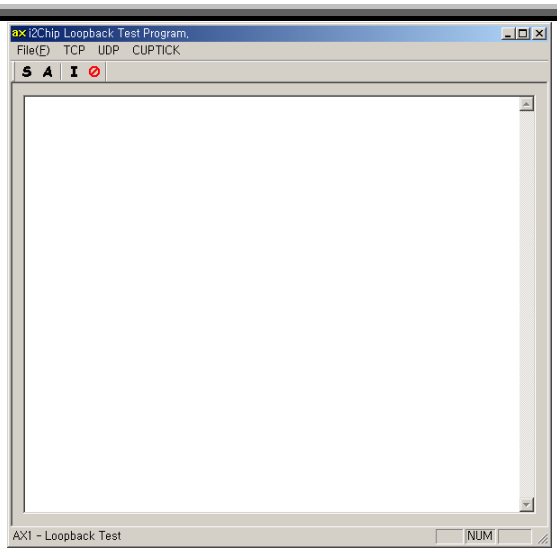
2.2.1.2 Loopback TCP Server Test

Run the ping command from the PC to the EVB8051 to check network operation.

※ By default, the IP of the EVB8051 is set to 192.168.0.2.

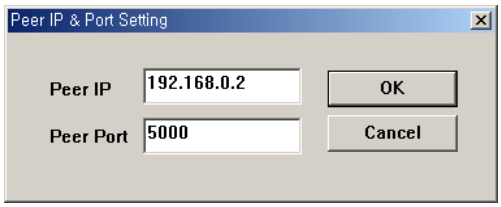
```
C:\> ping 192.168.0.2 –t
```

On the PC, run the AX1.exe program for connection setup. The screen will look like <Fig. 15>.



<Fig. 15: Running of AX1.exe Program>

From the 'TCP' menu of the AX1 program, select 'Connect' to display the dialog box as shown in <Fig. 16>. Enter the IP address assigned to the EVB8051 (192.168.0.2) and the Port (5000) number, and try the connection.

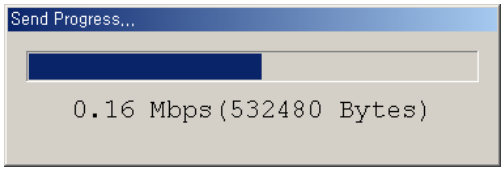


<Fig. 16: Input of the Connection Information>

Once a connection is set up between the EVB8051 and the computer, a box with the 'Connected' message appears as shown in <Fig. 17>.

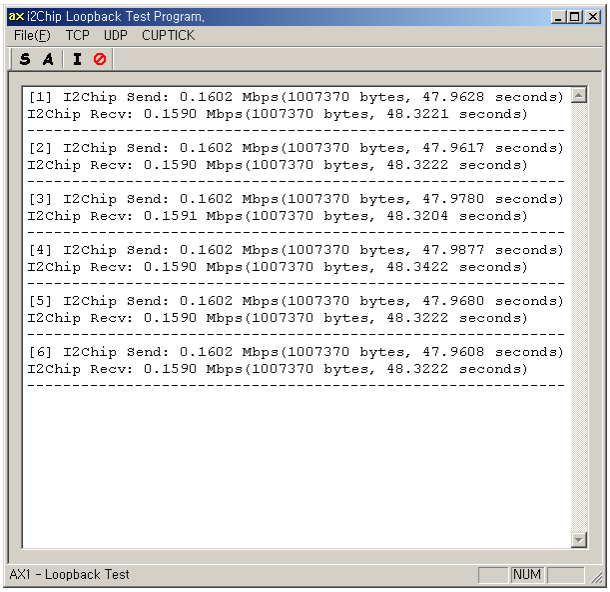
<Fig. 17: Connection Setup Completed>

After the connection setup, select ‘Send’ from the ‘File’ menu. The dialog box for file transfer appears.
Select a file to start the loop back test. Refer to <Fig. 18>.



<Fig. 18: File Transfer>

※ You can perform the Loopback test successively using the ‘A(uto)’ command or the ‘I(teration)’ command. Make sure to perform the ‘S(end)’ command before the ‘A(uto)’ command or the ‘I(teration)’ command. <Fig. 19> shows the result of ‘I(teration)’ command execution.

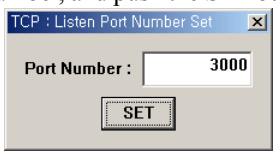

I2Chip Loopback Test Program.
File(F) TCP UDP CUPTICK
S A I
[1] I2Chip Send: 0.1602 Mbps(1007370 bytes, 47.9628 seconds)
I2Chip Recv: 0.1590 Mbps(1007370 bytes, 48.3221 seconds)
[2] I2Chip Send: 0.1602 Mbps(1007370 bytes, 47.9617 seconds)
I2Chip Recv: 0.1590 Mbps(1007370 bytes, 48.3222 seconds)
[3] I2Chip Send: 0.1602 Mbps(1007370 bytes, 47.9780 seconds)
I2Chip Recv: 0.1591 Mbps(1007370 bytes, 48.3204 seconds)
[4] I2Chip Send: 0.1602 Mbps(1007370 bytes, 47.9877 seconds)
I2Chip Recv: 0.1590 Mbps(1007370 bytes, 48.3422 seconds)
[5] I2Chip Send: 0.1602 Mbps(1007370 bytes, 47.9680 seconds)
I2Chip Recv: 0.1590 Mbps(1007370 bytes, 48.3222 seconds)
[6] I2Chip Send: 0.1602 Mbps(1007370 bytes, 47.9608 seconds)
I2Chip Recv: 0.1590 Mbps(1007370 bytes, 48.3222 seconds)
AX1 - Loopback Test
NUM

<Fig. 19: Loopback Test in Succession>

※ If the program does not run properly, try downloading the loopback program from the Software CD (\Software\Firmware\DirectMode\LB_TCP_SERVER\TCPS.HEX) into the EVB8051 again. For more information on program downloading, refer to Section 3.3.2.)

2.2.1.3 Loopback TCP Client Test

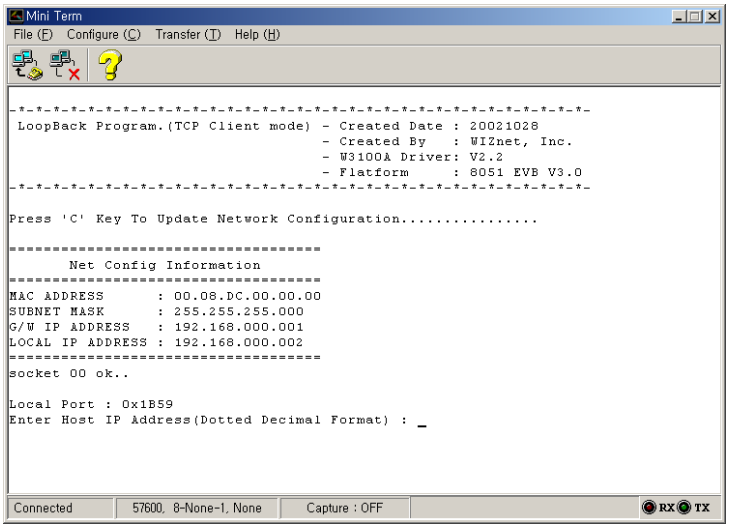
You can test Loopback TCP Client like Loopback Server.
On the PC, Run the AX1.exe program for connection setup.
From the 'TCP' menu of the AX1 program, select 'Listen' to display the dialog box as shown in <Fig. 20>. Enter the Port (3000) number, and push the SET button.



<Fig. 20: Input of the Listen port >

Next, try downloading the loopback client program from the Software CD (\Software\Firmware\DirectMode\LB_TCP_CLIENT\TCPC.HEX) into the EVB8051. For more information on program downloading, refer to Section 3.3.2.)

After reset EVB8051, you can see the image as shown in <Fig 21>.

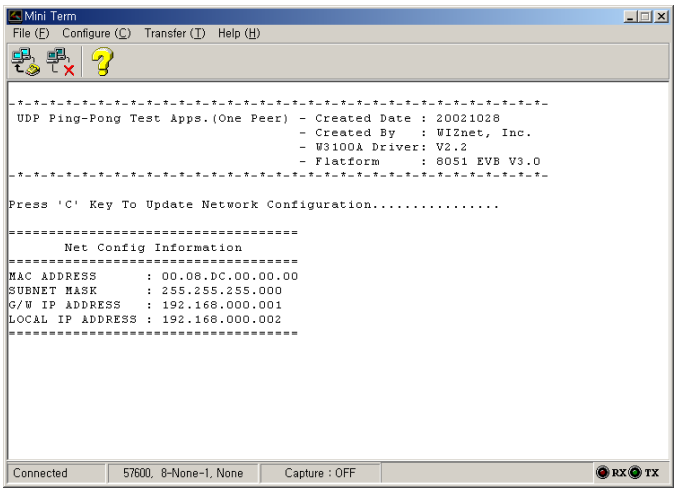

Mini Term
File (F) Configure (C) Transfer (T) Help (H)
-*-*-*

Input IP Address of your PC (ex : 192.168.0.5). then you can see a box with the 'Connected' message appears as shown in <Fig. 17>.
The next flow for test is same with Loopback TCP Server.

2.2.1.4 Loopback UDP Test

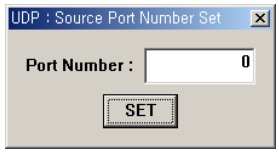
Loopback UDP is the sample code of UDP.
Download the UDP loopback program from the Software CD (\Software\Firmware\DirectMode\LB_UDP \UDP.HEX) into the EVB8051. For more information on program downloading, refer to Section 3.3.2.)

After reset EVB8051, you can see the image as shown in <Fig 22>.


Mini Term
File (F) Configure (C) Transfer (T) Help (H)
UDP Ping-Pong Test Apps.(One Peer) - Created Date : 20021028
- Created By : WIZnet, Inc.
- W3100A Driver: V2.2
- Flatform : 8051 EVB V3.0
Press 'C' Key To Update Network Configuration.....
Net Config Information
MAC ADDRESS : 00.08.DC.00.00.00
SUBNET MASK : 255.255.255.000
G/W IP ADDRESS : 192.168.000.001
LOCAL IP ADDRESS : 192.168.000.002
Connected
57600, 8-None-1, None
Capture : OFF
RX TX

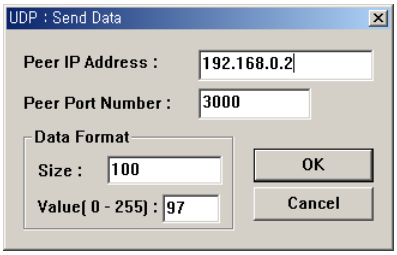
<Fig. 22: Starting Screen of UDP Loopback>

On the PC, Run the AX1.exe program.
From the 'UDP' menu of the AX1 program, select 'Open' to display the dialog box as shown in <Fig. 23>. And set port # of UDP for PC.



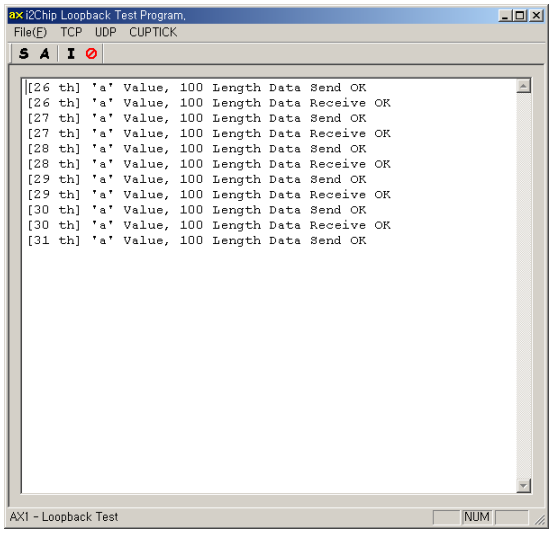
<Fig. 23: Open UDP Socket>

Select ‘Send’ to display the dialog box as shown in <Fig. 24>. Enter Peer IP Address, port #, data size and value for UDP loopback test of EVB8051. And push the OK button.



<Fig. 24: Input of the EVB8051 Information and Data Format>

Then, you can see the image as shown in <Fig. 25>. Now PC and EVB8051 are sending and receiving each other.


i2Chip Loopback Test Program.
File(F) TCP UDP CUPTICK
[26 th] 'a' Value, 100 Length Data Send OK
[26 th] 'a' Value, 100 Length Data Receive OK
[27 th] 'a' Value, 100 Length Data Send OK
[27 th] 'a' Value, 100 Length Data Receive OK
[28 th] 'a' Value, 100 Length Data Send OK
[28 th] 'a' Value, 100 Length Data Receive OK
[29 th] 'a' Value, 100 Length Data Send OK
[29 th] 'a' Value, 100 Length Data Receive OK
[30 th] 'a' Value, 100 Length Data Send OK
[30 th] 'a' Value, 100 Length Data Receive OK
[31 th] 'a' Value, 100 Length Data Send OK
AX1 - Loopback Test
NUM

<Fig. 25: UDP Test in Succession >

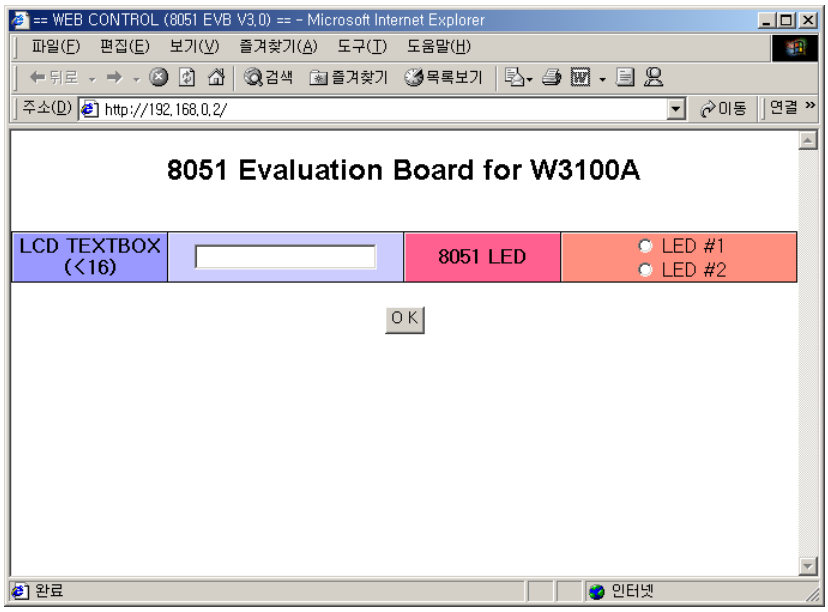
2.2.2 Web Server Test

2.2.2.1 Outline

The EVB8051 provides the source code to control the equipment through the web and is available for developing applications that require web server functions.

2.2.2.2 Testing Procedure

The test method for the web server is the same as for the Loopback test.
Download the web server program "\Software\Firmware\DirectMode\WEB_SERVER\ HTTPD.HEX" from the Software CD to the EVB8051 for testing. For more information on program downloading, refer to Section 3.3.2.
Run the ping command to the EVB8051 to check network operation. By default, the IP address of the EVB8051 is set to 192.168.0.2.
If the Ping command works properly, run the web browser on the PC and enter the IP address of the EVB8051 (192.168.0.2) in the URL window to attempt to access the web server of the EVB8051.
If the EVB8051 is running in web server mode, the starting screen of the web page will look like <Fig. 26>.



<Fig. 26: Home page for Web Page test of the EVB8051>

2.2.2.3 Functions of the Home page

(1) LCD Character Display
Entering characters in the LCD Text Box on the demo page will display the characters on the LCD of the EVB8051.

(2) LED Remote Control
It controls the LEDs on the board through the web. In actual applications, it can be used for controlling other devices than the LED in remote places through the web. Selecting LED#1 and LED#2 in <Fig. 26> will turn the LEDs (D1, D2) on the EVB8051 ON/OFF.

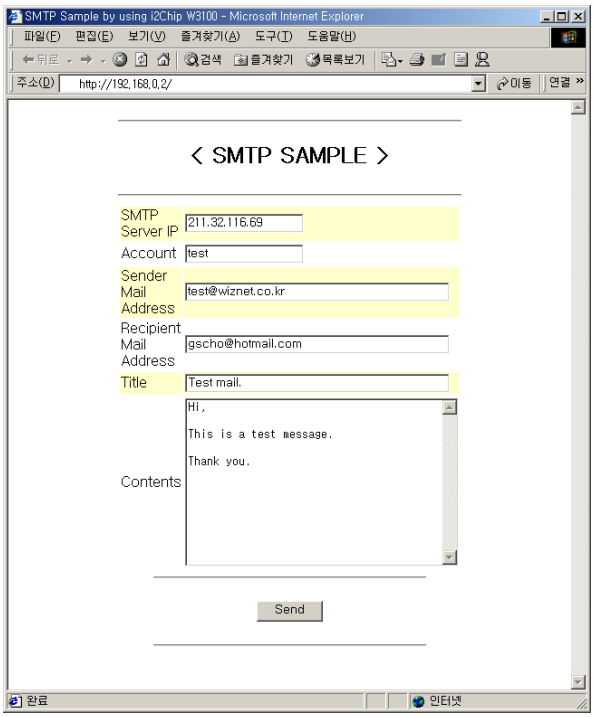
2.2.3 SMTP Test

2.2.3.1 Outline

The EVB8051 provides the source code to send E-Mail(SMTP) through the web and is available for developing applications that require SMTP functions.

2.2.3.2 Testing Procedure

The test method for the SMTP is the same as for the Web Server test.
Download the web server program "\Software\Firmware\DirectMode\SMTP_WEB\ SMTPWEB.HEX" from the Software CD to the EVB8051 for testing. For more information on program downloading, refer to Section 3.3.2.
Run the ping command to the EVB8051 to check network operation. By default, the IP address of the EVB8051 is set to 192.168.0.2.
If the Ping command works properly, run the web browser on the PC and enter the IP address of the EVB8051 (192.168.0.2) in the URL window to attempt to access the web server of the EVB8051.
If the EVB8051 is running in SMTP mode, the starting screen of the web page will look like <Fig. 27>.
Enter SMTP Server IP, Account, Sender Mail Address, Recipient Mail Address, Title, Contents. And push Send button. When completed, you can see the initial screen.
* Note: For this function test, SMTP server is reachable from EVB8051 and EVB8051 should be connected Internet.



<Fig. 27: Starting Screen for the Demo SMTP Page of the EVB8051 >

2.3 Troubleshooting Guide

2.3.1 Ping

When you cannot reach EVB8051 by Ping command,

Step 1. Did you connect correctly between test PC and EVB8051 with UTP cable?

Step 2. Did you change your test PC's network environment (IP address, Gateway, Subnet)?

If no, you should change it first as follows:

IP address: 192.168.0.5

Gateway address: 192.168.0.1

Subnet Mask: 255.255.255.0

Step 3. Whether NM7010A's Link LED(D4) is on?

If off, you'd better check whether the UTP cable works correctly.

2.3.2 Misc.

2.3.2.1 When the screen remains blank with the power on after a connection is made

Step 1. Check the connection condition of the serial cable.

Step 2. Check if the COM Port numbers of the PC and terminal coincide.

Step 3. Check the terminal configuration.

3. Programmer's Guide

3.1 API Function

3.1.1 Type of Functions

(1) Internal Function: Used inside the driver function
(2) API Function: Used in applications

Fu ıction Name	void Int0(void) interrupt 0
Ar ıuments	None
Re urn value	None
De scription	Interrupt handling function of the W3100A. Stores the status information that each function waits for in the global variable S_STATUS for transfer. S_STATUS stores the interrupt status value for each channel.
Ca egory	Internal Function

Fu nction Name	void ISR_ESTABLISHED(SOCKET s)
A guments	s: Channel number
R turn value	None
D scription	Established connection interrupt handling function. Called upon connection establishment, and may be inserted in user code if needed by the programmer.
C tegory	Internal Function

Fu nction Name	void ISR_CLOSED(SOCKET s)
Ar guments	s: Channel number
Re turn value	None
De scription	Closed connection interrupt handling function. Called upon connection closure, and may be inserted in user code if needed by the programmer.

Category	Internal Function

Fu nction Name	void ISR_RX(SOCKET s)
Ar guments	s: Channel number
Re turn value	None
De scription	Received data interrupt handling function. Called upon receiving data, and may be inserted in user code if needed by the programmer.
Ca tegory	Internal Function

Fu nction Name	void init W3100A(void)
Ar guments	None
Re turn value	None
De scription	W3100A initialization function. Function for S/W resetting of the W3100A. Sets the initial SEQ# to be used for TCP communication.
Ca tegory	API Function

Fu nction Name	void sysinit(u_char sbufsize, u_char rbufsize)
Ar guments	Sbufsize:tx memory size
Re turn value	rbufsize:rx memory size
De scription	W3100A initialization function. Sets the source MAC, source IP, gateway, and subnet mask to be used by the W3100A to the designated values. May be called when setting the concerned register to modify network information and reflect it on the W3100A.
Ca tegory	API Function

Fu nction Name	void setsubmask(u_char * addr)
Ar guments	addr: Pointer having the value for setting up the subnet mask
Re turn value	None
De scription	Subnet mask setup function

Ca :egory	API Function

Fu ıction Name	**void setgateway(u_char * addr)**
Ar juments	addr: Pointer having the value for setting up the gateway IP
Re :urn value	None
De scription	Gateway IP setup function
Ca :egory	API Function

Fu nction Name	**void setIP(u_char * addr)**
Ar guments	addr: Pointer having the value for setting up the source IP address
Re turn value	None
De scription	W3100A IP address setup function
Ca tegory	API Function

Fu nction Name	**void setMACAddr(u_char * addr)**
Ar guments	addr: Pointer having the value for setting up the MAC address
Re turn value	None
De scription	MAC address setup function
Ca tegory	API Function

Fu nction Name	**void settimeout(u_char * val)**
Ar guments	val: Pointer having the value for setting up the timeout. Upper 2 bytes have the initial timeout value, while the last 1 byte has the number of retransmissions until timeout.
Re urn value	None
De scription	TCP timeout setup function. Used for adjusting the TCP retransmission time. A timeout interrupt takes place when retransmission is attempted for establishing the connection or for data transfer beyond the set value.
Ca egory	API Function

Fu nction Name	**void setINTMask(u_char mask)**
Ar guments	mask: Value of the mask to be set (‘1’ refers to interrupt enable)
Re turn value	None
De scription	Interrupt mask setup function. Enables/disables the concerned interrupt.
Ca tegory	API Function

Function Name	void setbroadcast(SOCKET s)
Arguments	s: Channel number
Return value	None
Description	Broadcast data transfer enable setup function Enables/disables broadcasting data transfer in UDP or IP RAW mode.
Category	API Function

Function Name	void setTOS(SOCKET s, u_char tos)
Arguments	s: Channel number tos: Value to be set for the TOS field of the IP header
Return value	None
Description	Handles protocol setup function in IP RAW mode
Category	API Function

Function Name	char socket(SOCKET s, u_char protocol, u_int port, u_char flag)
Arguments	s: Channel number protocol: Protocol designated for the channel SOCK_STREAM(0x01) -> TCP SOCK_DGRAM(0x02) -> UDP SOCK_IPL_RAW(0x03) -> IP Layer RAW SOCK_MACL_RAW(0x04) -> MAC Layer RAW port: Source port designated for the channel flag: Options designated for the channel SOCKOPT_BROADCAST(0x80) -> '1' refers to broadcast data transfer in UDP mode SOCKOPT_NDTIMEOUT(0x40) -> '1' refers to use of only the register that designates the timeout value SOCKOPT_NDACK(0x20) -> '1' refers to the delayed ACK not to be used SOCKOPT_SWS(0x10) -> '1' refers to the silly window syndrome to be used
Return value	Channel number if succeeded, or –1 if failed.

Description	Initialization of the channel. Initializes the designated channel and waits for completion of W3100A handling.
Category	API Function

Function Name	**char connect(SOCKET s, u_char * addr, u_int port)**
Arguments	s: Channel number addr: Destination IP address port: Destination port number
Return value	1 if connection is established, or –1 if connection fails.
Description	Sets the connection to the designated peer. Establishes a connection with a peer on the designated channel and waits until the connection is established. (TCP client mode)
Category	API Function

Function Name	char listen(SOCKET s, u_char * addr, u_int * port)
Arguments	s: Channel number addr: Peer IP address at the time of connection establishment port: Peer Port number at the time of connection establishment
Return value	1 if connection is established, or –1 if connection fails.
Description	Waits for connection with a peer. (Blocking Mode) The designated channel waits for connection by a peer. (TCP Server mode)
Category	API Function

Function Name	char NBlisten(SOCKET s)
Arguments	s: Channel number
Return value	1
Description	Waits for connection with a peer. (Non-blocking Mode) The designated channel waits for connection by a peer. (TCP Server mode)
Category	API Function

Function Name	void initseqnum(SOCKET s)
Arguments	s: Channel number
Return value	None
Description	Generates random values for the initial SEQ# to be used for establishing a TCP connection. This function may be added to the code for generating random numbers for assigning a random number to initial SEQ# used in TCP. In an actual internet environment, the initial SEQ# must be a random number. (A fixed number is used for EVB/DK.)
Category	API Function

Function Name	u_int send(SOCKET s, u_char * buf, u_int len)

Arguments	s: Channel number buf: Pointer indicating the data to be sent len: Size of the data to be sent
Return value	Sent data size
Description	Function for sending TCP data. Composed of the send()and send_in() functions. The send() function is an application I/F function. It continues to call the send_in() function to complete the sending of the data up to the size of the data to be sent when the application is called. The send_in() function receives the return value (the size of the data sent), calculates the size of the data to be sent, and calls the send_in() function again if there is any data left to be sent.
Category	API Function

Fu ıction Name	u_int send_in(SOCKET s, u_char * buf, u_int len)
Ar ıuments	s: Channel number buf: Pointer indicating the data to be sent len: Size of the data to be sent
Re urn value	Sent data size
De scription	Internal function for sending TCP data. Called by the send() function for TCP transmission. It first calculates the free transmit buffer size and compares it with the size of the data to be transmitted to determine the transmission size. After calculating the data size, it copies data from TX_WR_PTR. It waits if there is a previous send command in process. When the send command is cleared, it updates the TX_WR_PTR up to the size to be transmitted and performs the send command.
Ca egory	Internal Function

Fu ıction Name	u_int recv(SOCKET s, u_char * buf, u_int len)
Ar ıuments	s: Channel number buf: Pointer where the data to be received is copied len: Size of the data to be received
Re urn value	Received data size
De scription	TCP data receiving function. The recv() function is an application I/F function. It continues to wait for as much data as the application wants to receive.
Ca egory	API Function

Fu ıction Name	u_int sendto(SOCKET s, const u_char * buf, u_int len, u_char * addr, u_int port)
Ar ıuments	s: Channel number buf: Pointer indicating the data to send len: Size of the data to send addr: Destination IP address
Re urn value	Sent data size

Description	UDP data sending function. Composed of the sendto()and sendto_in() functions. The send() function is an application I/F function. It continues to call the send_in() function to complete the sending of the data up to the size of the data to be sent when the application is called. Unlike TCP transmission, it designates the destination address and the port.
Category	API Function

Fu nction Name	u_int sendto_in(SOCKET s, const u_char * buf, u_int len)
Ar guments	s: Channel number buf: Pointer indicating the data to send len: Size of the data to send
Re urn value	Sent data size
De scription	UDP data sending function. An internal function that is the same as the send_in() function of the TCP.
Ca egory	Internal Function

Fun ction Name	u_int recvfrom(SOCKET s, u_char * buf, u_int len, u_char * addr, u_int * port)
Arg uments	s: Channel number buf: Pointer where the data to be received is copied len: Size of the data to be received addr: Peer IP address for receiving port: Peer port number for sending
Ret rn value	Received data size
Des cription	UDP data receiving function. Function for receiving UDP and IP layer RAW mode data, and handling the data header.
Cat gory	API Function

Fun ction Name	char close(SOCKET s)
Arg uments	s: Channel number
Ret rn value	1
Des cription	Channel closing function. Function for closing the connection of the designated channel.
Cat gory	API Function

Fun :tion Name	u_int select(SOCKET s, u_char func)
Arg iments	s: Channel number func: SEL_CONTROL(0x00) -> return socket status SEL_SEND(0x01) -> return free transmit buffer size SEL_RECV(0x02) -> return data size in receive buffer
Ret rn value	Socket status or free transmit buffer size or received data size
Des :ription	Function handling the channel socket information.
Cat gory	API Function

Fun :tion Name	u_int read_data(SOCKET s, u_char * src, u_char * dst, u_int len)
Arg iments	s: Channel number src: Receive buffer pointer of the W3100A dst: System buffer pointer len: Data size to be copied
Ret rn value	Copied data size
Des :ription	Copies the receive buffer data of the W3100A to the system buffer. It is called from the recv()or recvfrom() function.
Cat gory	Internal Function

Fun :tion Name	u_int write_data(SOCKET s, u_char * src, u_char * dst, u_int len)
Arg iments	s: Channel number src: System buffer pointer dst: Transmit buffer pointer of the W3100A len: Data size to be copied
Ret rn value	Copied data size
Des :ription	Copies the system buffer data to the transmit buffer of the W3100A. It is called from the send_in()or sendto_in() function.
Cat gory	Internal Function

Fun :tion Name	**void wait_10ms(int cnt)**
Arg ıments	cnt: count
Ret rn value	None
Des :ription	Designates the delay. Waits for 10 milliseconds.
Cat gory	Internal Function

Fun :tion Name	**void wait_1ms(int cnt)**
Arg ıments	cnt: count
Ret rn value	None
Des :ription	Designates the delay. Waits for 1 millisecond.
Cat gory	Internal Function

Fun :tion Name	**void wait_1us(int cnt)**
Arg ıments	cnt: count
Ret rn value	None
Des :ription	Designates the delay. Waits for 1 millisecond.
Cat gory	Internal Function

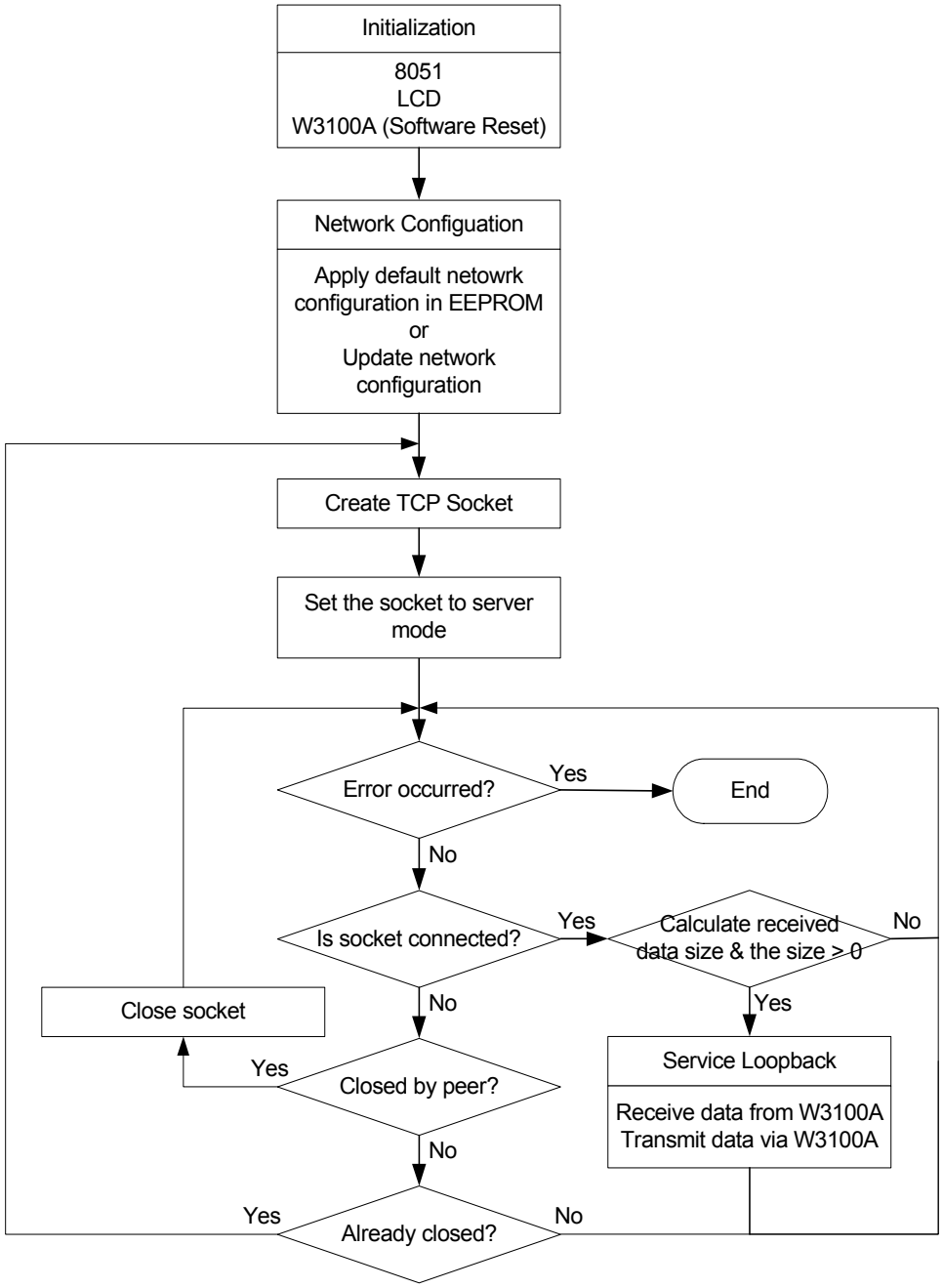
3.2 Sample Source Codes

3.2.1 Loopback & TCP Server

3.2.1.1 Source Codes : \Software\Firmware\DirectMode\

LB_TCP_SERVER\

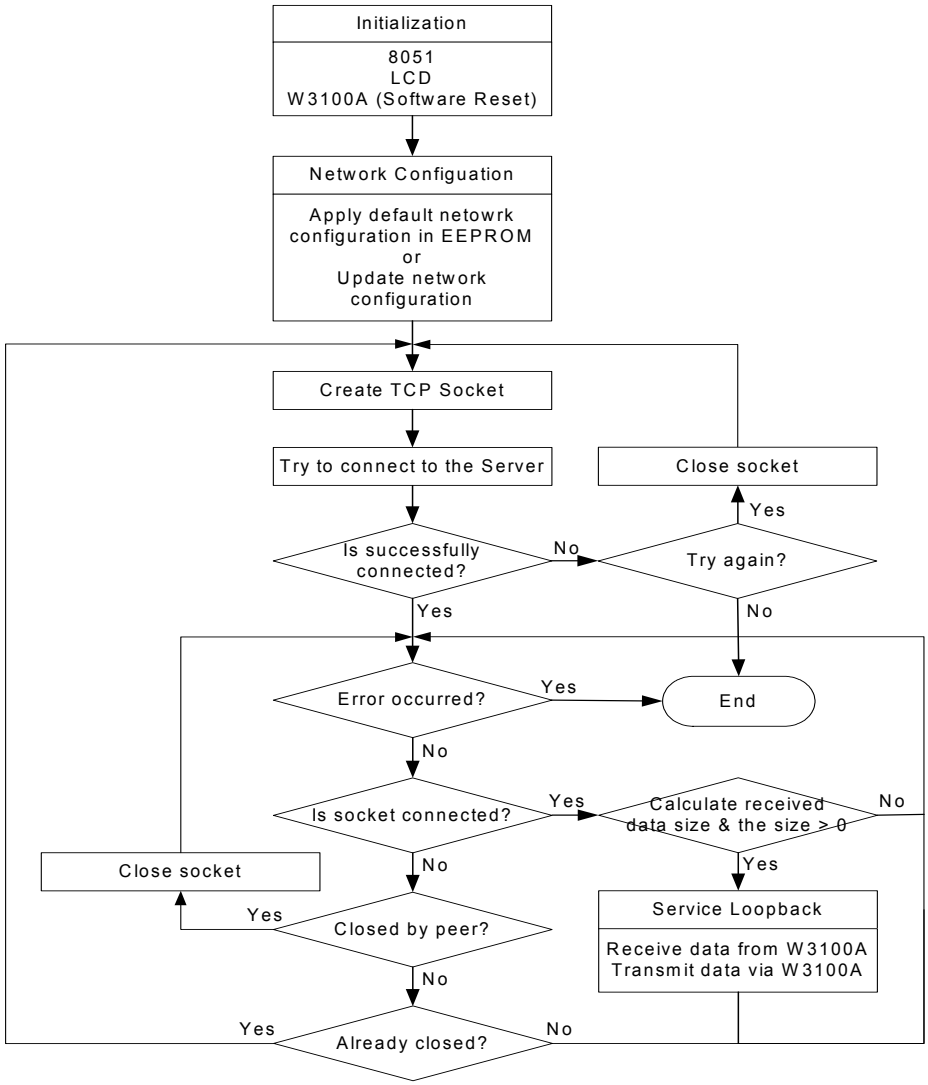
3.2.1.2 Flow Diagram



3.2.2 Loopback & TCP Client

3.2.2.1 Source Codes : \Software\Firmware\DirectMode \LB_TCP_CLIENT\

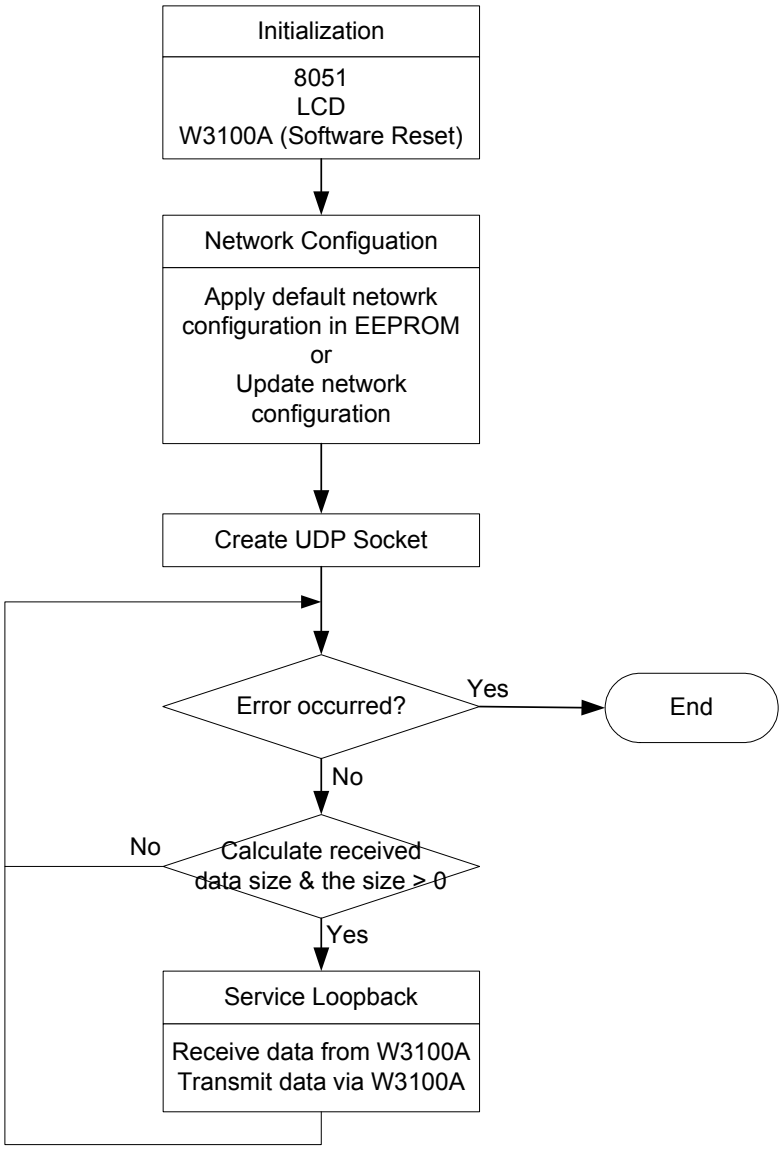
3.2.2.2 Flow Diagram



3.2.3 Loopback & UDP

3.2.3.1 Source Codes : \Software\Firmware\DirectMode\LB_UDP\

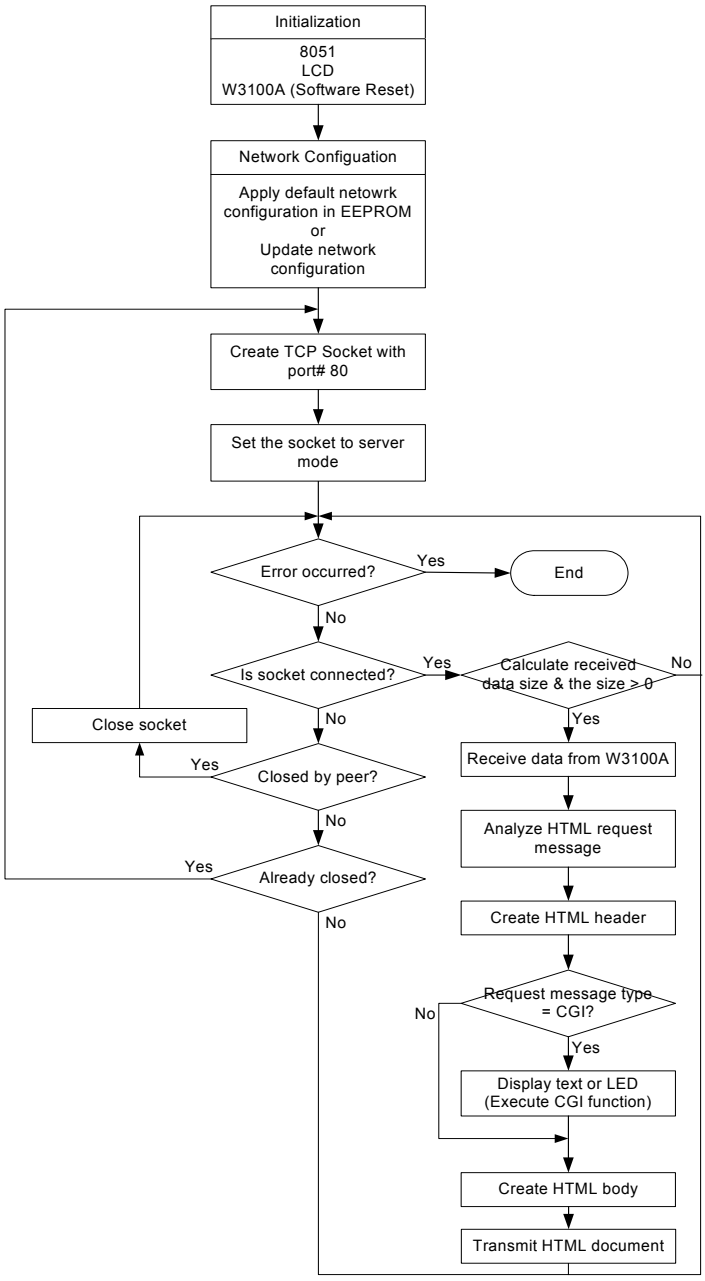
3.2.3.2 Flow Diagram



3.2.4 Web Server

3.2.4.1 Source Codes : \Software\Firmware\DirectMode\WEB_SERVER\

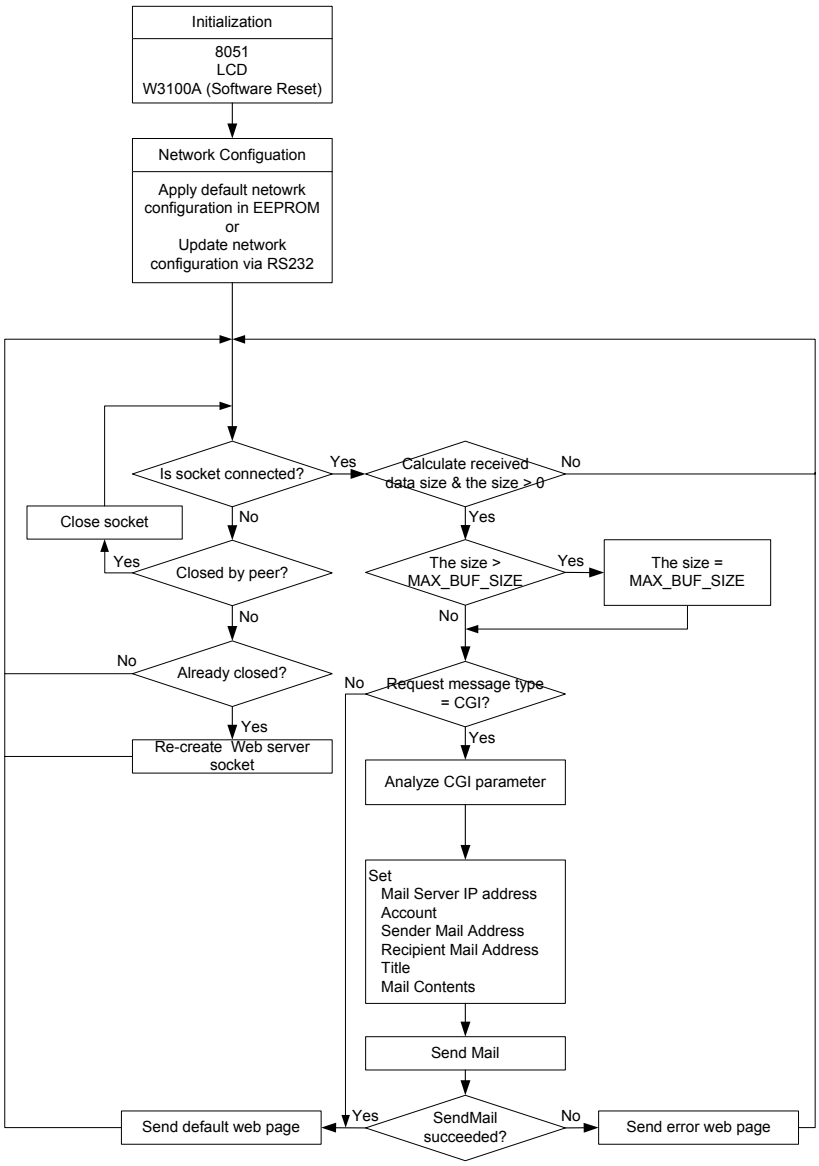
3.2.4.2 Flow Diagram


Initialization
8051
LCD
W3100A (Software Reset)
Network Configuation
Apply default netowrk configuration in EEPROM
or
Update network configuration
Create TCP Socket with port# 80
Set the socket to server mode
Error occurred?
Yes
End
No
Is socket connected?
Yes
Calculate received data size & the size > 0
No
Close socket
No
Yes
Receive data from W3100A
Yes
Closed by peer?
No
Analyze HTML request message
Yes
Already closed?
No
Create HTML header
Request message type = CGI?
No
Yes
Display text or LED (Execute CGI function)
Create HTML body
Transmit HTML document

3.2.5 SMTP_WEB

3.2.5.1 Source Codes : \Software\Firmware\DirectMode\SMTP_WEB\

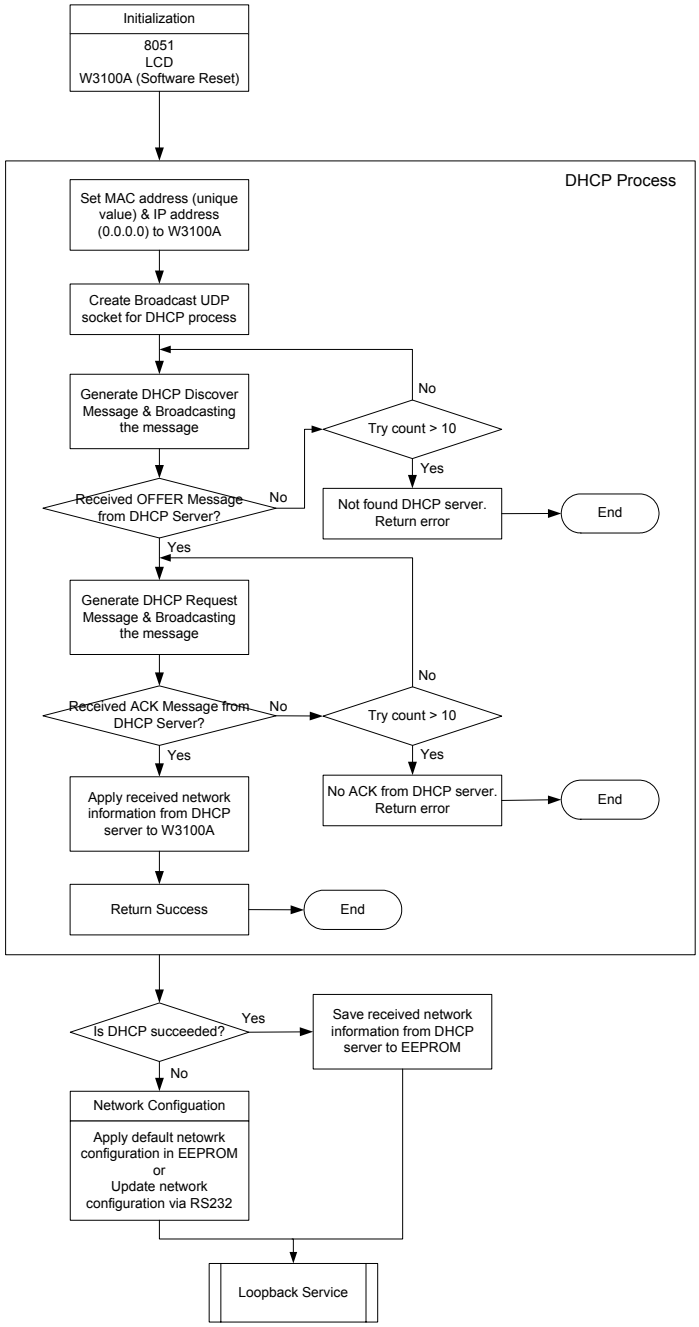
3.2.5.2 Flow Diagram



3.2.6 DHCP

3.2.6.1 Source Codes : \Software\Firmware\DirectMode\DHCP\

3.2.6.2 Flow Diagram


Initialization
8051
LCD
W3100A (Software Reset)
DHCP Process
Set MAC address (unique value) & IP address (0.0.0.0) to W3100A
Create Broadcast UDP socket for DHCP process
Generate DHCP Discover Message & Broadcasting the message
No
Try count > 10
Yes
Received OFFER Message from DHCP Server?
No
Not found DHCP server. Return error
End
Yes
Generate DHCP Request Message & Broadcasting the message
No
Received ACK Message from DHCP Server?
No
Try count > 10
Yes
Yes
Apply received network information from DHCP server to W3100A
No ACK from DHCP server. Return error
End
Return Success
End
Is DHCP succeeded?
Yes
Save received network information from DHCP server to EEPROM
No
Network Configuation
Apply default netowrk configuration in EEPROM
or
Update network configuration via RS232
Loopback Service

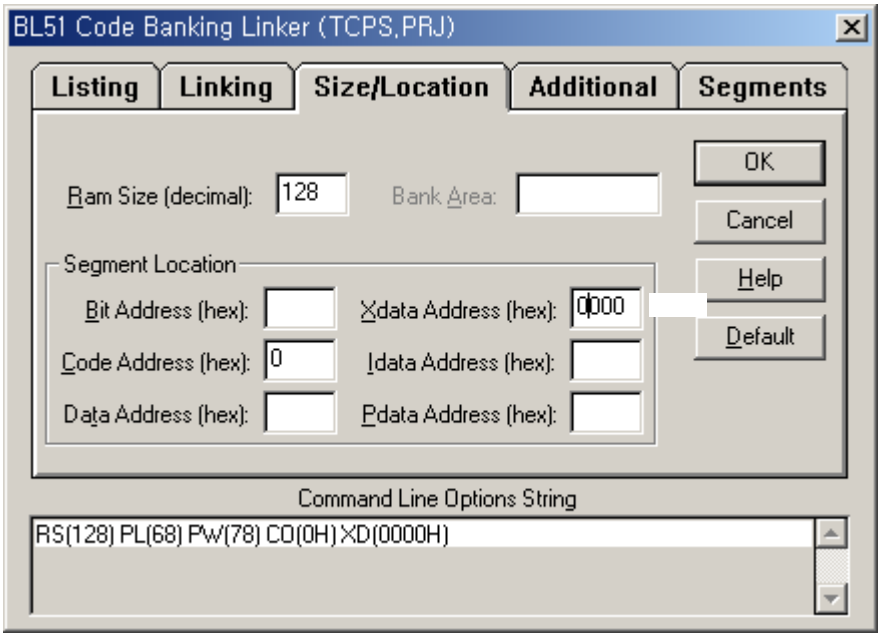
3.3 Application Development Procedure

3.3.1 Program Developing Procedure (based on the KEIL compiler)

* Note: For this developing procedure, you need KEIL compiler and FLIP by ATMEL.

3.3.1.1 Configuration

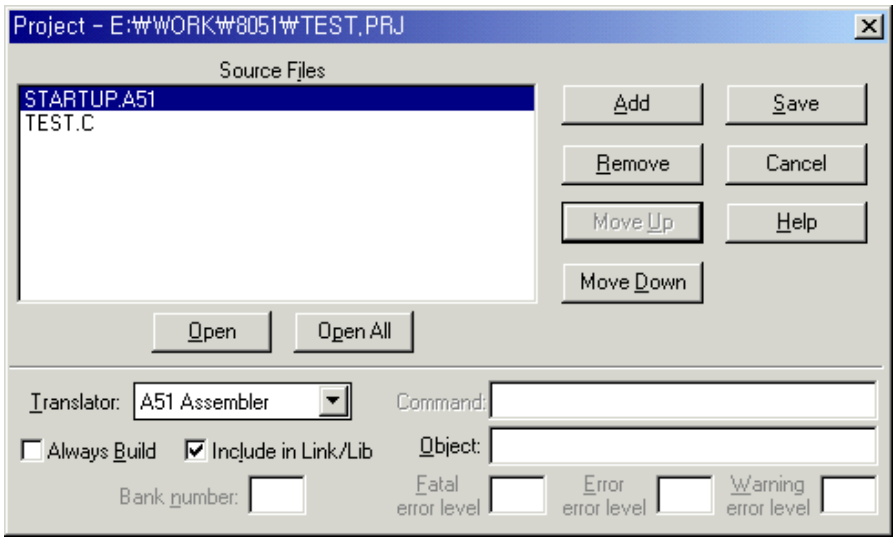
1. Run uVision-51.
2. In Options->BL51 Code Banking Linker, set the Xdata Address arbitrarily in the SRAM area and the Code Address to 0. (Refer to the section 3.3.3 Memory Map.)



<Fig. 28: uVision-51>

Making a New Project

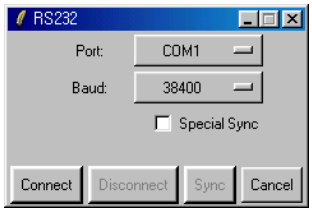
1. Make a new project and add startup.a51 and necessary sources.
   (Startup.a51 file does not need to be modified.)
2. Modify or develop the program.
3. Compile it



<Fig. 29: Making a new project>

3.3.2 Program Downloading and Running Procedure (based on Flip by ATMEL)

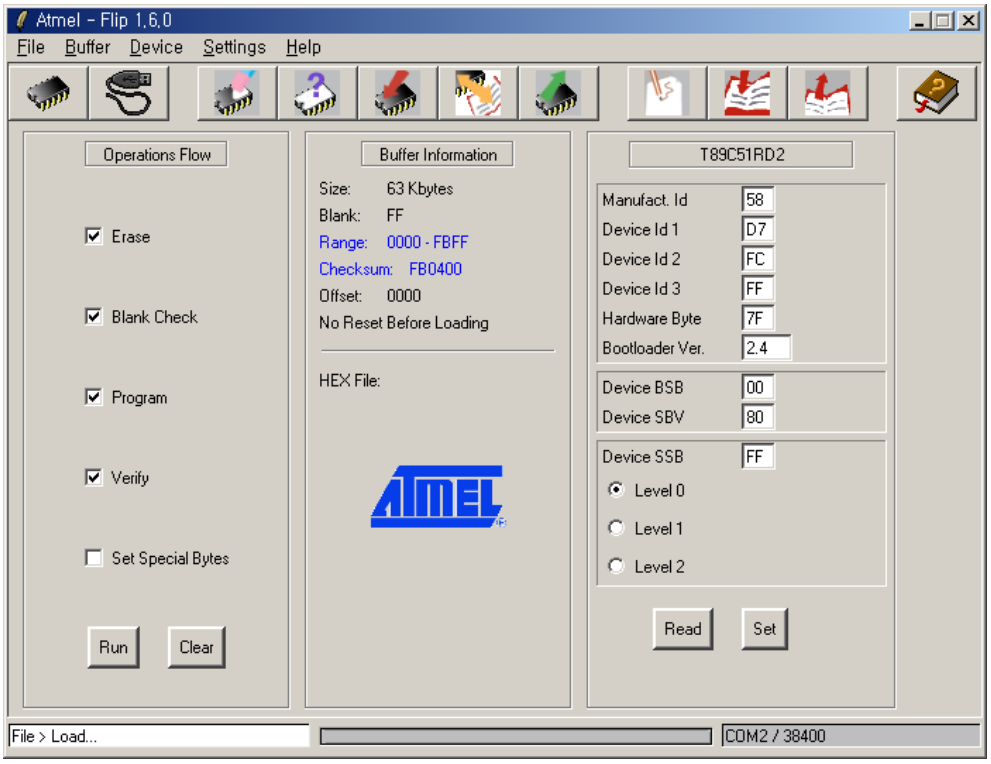
1. Connect the 8051EVB and the COM port of the PC with the serial cable.
2. Slide the switch on the JP3 to the left and turn on the power.
3. Run Flip, the ISP program of ATMEL, and select T89C51RD2 as the device. (Device>Select… => T89C51RD2)
4. Select Setting>Communication>RS232 and click the Connect button.



<Fig. 30: Setting RS232>

5. Execute File > Load HEX… to load the file to be downloaded.
6. Press the Run button to reprogram the internal flash memory of the 8051 in accordance with the Operation Flow.

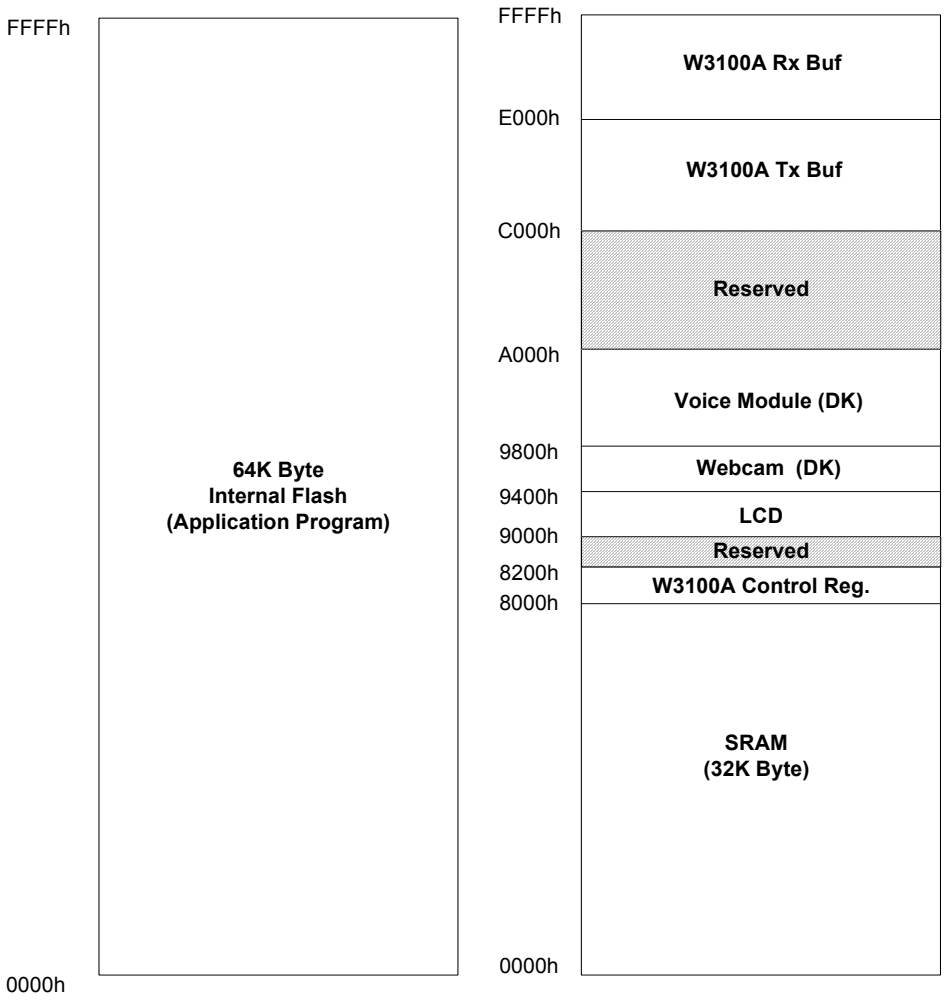
7. Turn off the power, slide the switch on JP3 to the right, and turn on the power back to run the program that was downloaded in step 6.



<Fig. 31: FLIP by ATMEL>

* Note: Recent version of FLIP is highly recommended.

3.3.3 Memory Map



<Fig. 32: Memory of EVB8051>

4. Hardware Designer's Guide

4.1 EVB8051 Schematic

Please refer to schematics in Software CD (\Schematic\).

4.2 PAL

Please refer to detailed information in Software CD (\Schematic\PAL\).

```
library ieee;
use ieee.std_logic_1164.all;

entity test is
        port(
          Addr          : in std_logic_vector(5 downto 0);
          nPSEN         : in std_logic;
          nRD           : in std_logic;
          nWR           : in std_logic;
          nEA           : in std_logic;
          nROMCS        : out std_logic;
          nRAMCS        : out std_logic;
          nCS_IINCHIP : out std_logic;
          LCDCS                 : out std_logic;
          nCS_VM        : out std_logic;
          nCS_CAM       : out std_logic;
          nROMRD        : out std_logic;
          nRAMRD        : out std_logic
        );

ATTRIBUTE pin_numbers of test:ENTITY IS
"Addr(5):6 "
& "Addr(4):5 "
& "Addr(3):4 "
& "Addr(2):3 "
& "Addr(1):2 "
& "Addr(0):1 "
& "nPSEN:9 "
& "nRD:7 "
& "nWR:8 "
& "nEA:11 "
```

```
& "nROMCS:12 "
& "nRAMCS:13 "
& "nCS_IINCHIP:15 "
& "LCDCS:14 "
& "nCS_VM:16 "
& "nCS_CAM:19 "
& "nROMRD:17 "
& "nRAMRD:18 ";
end test;

architecture arch_test of test is
begin
   nROMRD <= nPSEN;
   nRAMRD <= nRD;

   -- nROMCS    (0x0000 - 0x7fff) : External ROM
   process(Addr, nPSEN)
   begin
      if (((Addr >= "000000") and (Addr < "100000")) and (nPSEN = '0')) then
         nROMCS <= '0';
            else
         nROMCS <= '1';
            end if;
   end process;

   --nRAMCS (0x0000 - 0x7fff) :
   process(Addr, nPSEN)
   begin
      if (((Addr >= "000000") and (Addr < "100000")) and (nPSEN = '1')) then
         nRAMCS <= '0';
            else
         nRAMCS <= '1';
            end if;
   end process;


   --LCDCS (0x9000 - 0x93ff)
   process(Addr, nRD, nWR)
   begin
      if (((Addr >= "100100") and (Addr < "100101")) and (nRD = '0' or nWR = '0')) then
         LCDCS <= '1';
            else
         LCDCS <= '0';
            end if;
```

```
   end process;

   -- CAM (0x9400 - 0x9800)
   process(Addr)
   begin
      if ((Addr >= "100101") and (Addr < "100110")) then
               nCS_CAM <= '0';
            else
               nCS_CAM <= '1';
            end if;
   end process;

    -- VM (0x9800 - 0xA000)
   process(Addr)
   begin
      if ((Addr >= "100110") and (Addr < "101000")) then
               nCS_VM <= '0';
            else
               nCS_VM <= '1';
            end if;
   end process;

-- W3100A (0x8000 - 0x9000, 0xC000 - 0x10000)
process(Addr)
   begin
      if (((Addr >= "100000") and (Addr < "100100")) or (Addr >= "110000")) then
               nCS_IINCHIP <= '0';
            else
               nCS_IINCHIP <= '1';
            end if;
   end process;


end arch_test;


-- W3100A (0x8000 - 0x9000, 0xC000 - 0x10000)
process(Addr, nRD, nWR)
   begin
      if (((Addr >= "100000") and (Addr < "100100")) or (Addr >= "110000")) and (nRD = '0' or
nWR = '0')then
               nCS_IINCHIP <= '0';
            else
               nCS_IINCHIP <= '1';
```

```
            end if;
    end process;
end arch_test;
```

4.3 Parts List

Please refer to part list in Software CD (\Schematic\DirectMode\Partlist\).

Appendix A. Quick Testing Procedure

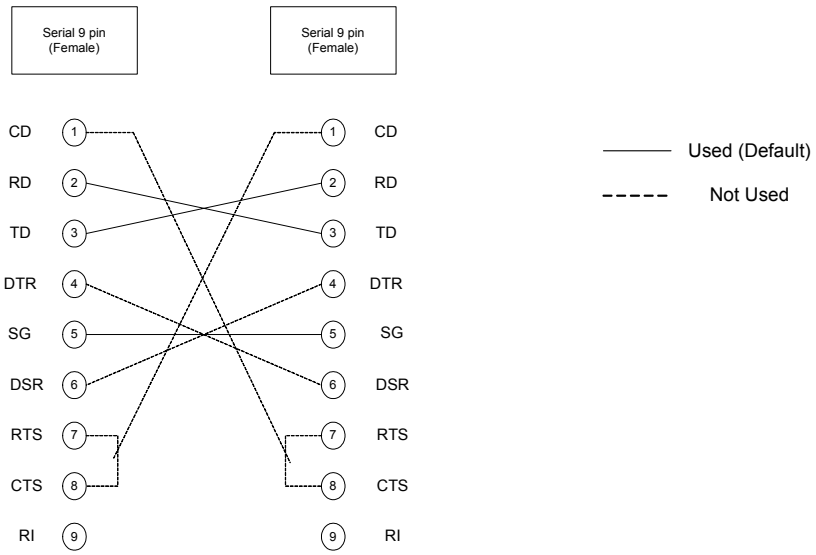
A.1 Loopback Test

Step 1. Check whether EVB8051 is connected to PC correctly with UTP cable.
Step 2. Slide JP3 on EVB8051 to the right and turn on the power of EVB8051.
Step 3. Ping to EVB8051 (192.168.0.2) on the PC whether EVB8051 is connected to the PC correctly.
Step 4. Install Axinstall.exe (only for the first time) and run Ax1.exe on the PC.
Step 5. Select TCP\Connect menu and enter EVB8051's IP address and Port number (5000).
Step 6. Select File\Send menu and select a file to transfer.

A.2 Web Server Test

Step 1. Connect the EVB8051 and the COM port of the PC with the serial cable.
Step 2. Slide the switch on the JP3 to the left and turn on the power.
Step 3. Run Flip and select T89C51RD2 as the device in Device\Select … menu.
Step 4. Select Setting\Communication\RS232 menu and click the 'Connect' button.
Step 5. Select File\Load HEX… to load httpd.hex to be downloaded.
Step 6. Press the 'Run' button to reprogram the internal flash memory of the 8051 in accordance with the
Operation Flow.
Step 7. Turn off the power of EVB8051 and slide the switch on JP3 to the right, and turn on the power back
to run the program that was downloaded in step 6.
Step 8. Run web browser on the PC and enter URL, "http://192.168.0.2"

Appendix B. Specification of Serial Cables



TD (Transmit Data) : Serial Data Output (TXD)
RD (Receive Data) : Serial Data Input (RXD)
CTS (Clear to Send) : This line indicates that the Modem is ready to exchange data.
DCD(Data Carrier Detect) : When the modem detects a "Carrier" from the modem at the other end of the phone line, this Line becomes active.
DSR (Data Set Ready) : This tells the UART that the modem is ready to establish a link.
DTR (Data Terminal Ready) : This is the opposite to DSR. This tells the Modem that the UART is ready to link.
RTS (Request To Send) : This line informs the Modem that the UART is ready to exchange data.
RI (Ring Indicator) : Goes active when modem detects a ringing signal from the PSTN.

Appendix C. Specification of NM7010A

NM7010A is a module that consists of W3100A, Ethernet PHY and Mac Jack. It's used as module like a component, no effort is required to interface W3100A, PHY chip,Transformer, and RJ45. It's the simplest and easiest solution to provide Internet connectivity.

C.1 Advantages

Easy design-win by reusing drop-in network module

Users don't need to know details of network circuits

Auto-detects 10/100 Mbps Ethernet speed

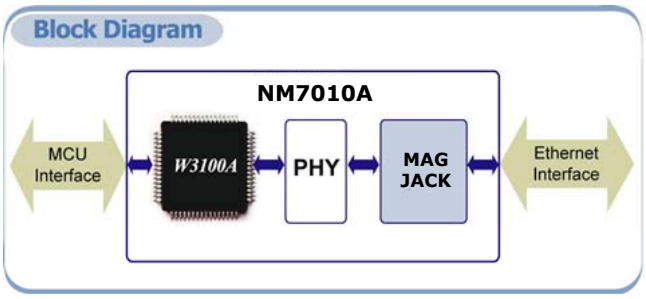
C.2 Components

TCP/IP:W3100A

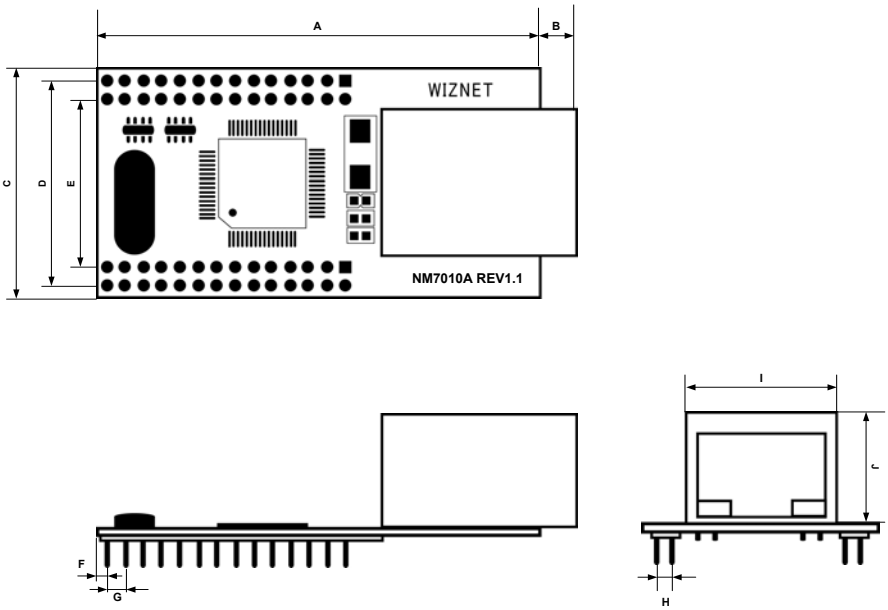
Ethernet physical layer:RTL8201BL

Connector:RJ45(with transformer)

C.3 Block Diagram



C.4 Module dimension



Symbol	Dimens on (mm)
A	48.0
B	4.0
C	25.0
D	20.4
E	16.4
F	1.0
G	2.0
H	2.0
I	16.0
J	13.4

C.5 Pin description

I : Input O : Output

I/O : Bi-directional Input and output P : Power

Power & Ground

Symbol	Type	Pin No.	Descriptio .
VCC	P	JP1 : 1 , JP2 : 24	Power : 3.3 V power supply for NM7000A
GND	P	JP1 : 8, JP1 : 13, JP1 : 24, JP2 : 1 JP2 : 7, JP2 : 13 JP2 : 14, JP2 : 23	Ground

MCU Interfaces

Symbol	Type	Pin No.	Descriptic ı
A14~A8	I	JP1 : 7, JP1 : 10 JP1 : 9, JP1 : 12 JP1 : 11, JP1 : 14 JP1 : 15	Address / Device Address : Used as Address[14-8] pin when set in Bus access mode. Used as Device Address[6-0] pin when set in I^2C interface mode.

A7~A0	I	JP1 : 16 ~ JP1 : 23	Address **: Used as Address[7-0] pin when set in Bus access mode.** Not used when set in I^2C interface mode. Leave them NC or ground them when they are not used.
D7~D0	I/O	JP2 : 21, JP2 : 22 JP2 : 19, JP2 : 20 JP2 : 17, JP2 : 18 JP2 : 15, JP2 : 16	Data : Used as Data[7-0] pin.
/CS	I	JP1 : 5	Module Select : Active low. Drives /CS of the W3100A
/RD	I	JP1 : 4	Read Enable : Active low. Drives /RD of the W3100A
/WR	I	JP1 : 3	Write Enable : Active low. Drives /WR of the W3100A
/INT	O	JP1 : 2	Interrupt : Active low Indicates that the W3100A requires MCU attention after reception or transmission. The interrupt is cleared by writing to the ISR of W3100A(Interrupt Status Register). All interrupts are maskable by writing IMG of W3100A(Interrupt Mask Register). This signal is active low.
I_SCL	I	JP2 : 25	SCL : clock used by I^2C interface

			mode. This pin is positioned as pull-down internally.
I_SDA	I/O	JP2 : 26	**SDA** : data used by I^2C interface mode. This pin is positioned as pull-down internally.

Network status Indicator LEDs

Symbol	Type	Pin No.	Description
L_COL	O	JP2 : 6	**Collision LED** : Active low when collisions occur.
L_100ACT	O	JP2 : 8	**Link 100/ACT LED** : Active low when linked 100 Base TX, and blinking when transmitting or receiving data.
L_10ACT	O	JP2 : 10	**Link 10/ACT LED** : Active low when linked 10 Base T, and blinking when transmitting or receiving data.
L_DUPX	O	JP2 : 11	**Full Duplex LED** : Active low when in full duplex operation. Active high when in half duplex operation.
L_LINK	O	JP2 : 12	**Link LED** : Active low when linked

Miscellaneous Signals (Reset, Mode setting etc.)

Symbol	Type	Pin No.	Description
RESET	I	JP1 : 6	**Reset** : Active high Initializes or Reinitializes the W3100A. Asserting this pin will

<table>
<tr><td></td><td></td><td></td><td>force a reset process to occur which will result in all internal registers reinitializing to their default and all strapping options are reinitialized. For complete reset function, this pin must be asserted low for at least 10us. Refer to W3100A datasheet for further detail regarding reset.</td></tr>
<tr><td>/RESET</td><td>I</td><td>JP2 : 2</td><td>Reset : Active low
Reset RTL8201BL chip. For complete reset function, this pin must be asserted low for at least 10ms.</td></tr>
<tr><td>MODE1~0</td><td>I</td><td>JP1 : 25 , JP1 : 26</td><td>Mode Select : This pin selects MCU interface and operating mode. Since each pin is positioned as pull-down internally, clocked mode – the default mode – is selected when the pins is not connected.
<table>
<tr><th>M1 M0</th><th>Mode</th></tr>
<tr><td>0 0</td><td>Clocked</td></tr>
<tr><td>0 1</td><td>External clocked</td></tr>
<tr><td>1 0</td><td>Non-clocked</td></tr>
<tr><td>1 1</td><td>I^2C interface</td></tr>
</table>
Refer to the W3100A datasheet for more information of setting modes.</td></tr>
<tr><td>EXT_CLK</td><td>I</td><td>JP1 : 28</td><td>External clock : supplementary clock used for external clocked mode.
In external clocked mode, W3100A</td></tr>
</table>

			use this clock to interface with MCU. Refer to the W3100A datasheet for more information.
NC	-	JP1 : 27, JP2 : 3 JP2 : 5, JP2 : 9 JP2 : 27 , JP2 : 28	Not Connect JP1 : 27Pin is used for factory test. This pin must not be used by users.

Appendix D. Specification of NM7000A

NM7000A is a module that consists of W3100A and Ethernet PHY.
It's used as a module like a component, no effort is required to interface W3100A and PHY chip.
So users can design quickly and easily and save the cost and time-to-market.

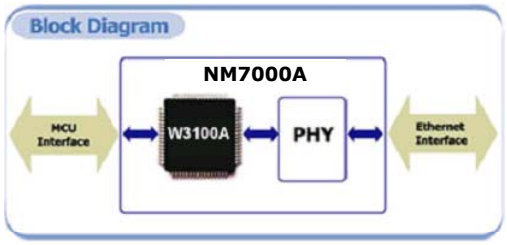
C.1 Advantages

Easy design by reusing drop-in network module
No need to know details of network circuits
Auto-detecting 10/100 Mbps Ethernet interface

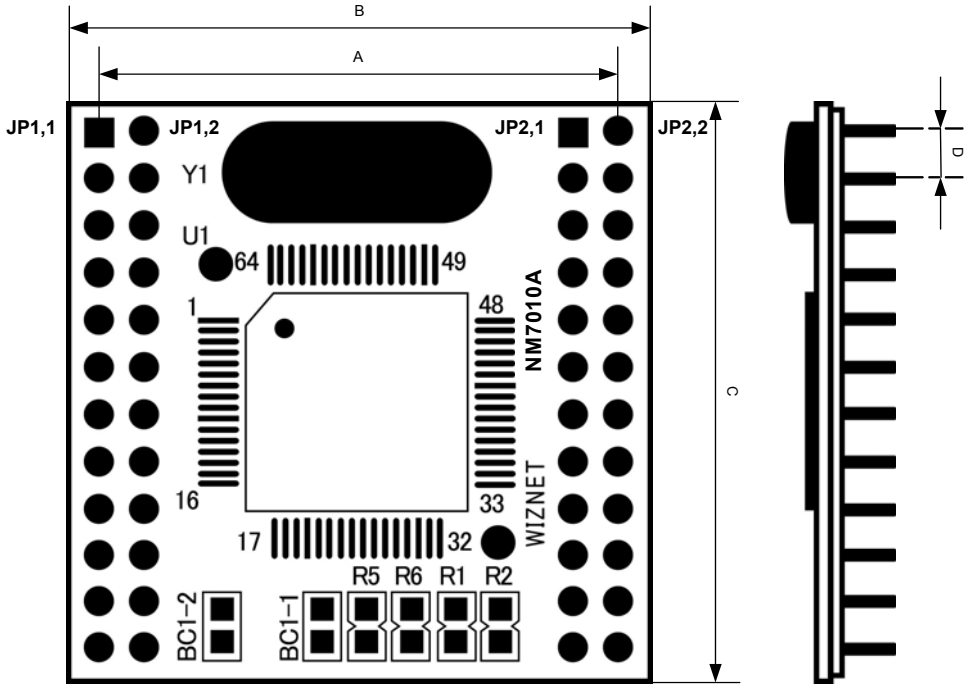
C.2 Components

TCP/IP:W3100A
Ethernet physical layer:RTL8201BL

C.3 Block Diagram



C.4 Module dimension



Symbol	Dimensi ›n in mm
A	22.4
B	25.0
C	25.0
D	2.0

C.5 Pin description

I : Input O : Output

I/O : Bi-directional Input and output P : Power

Power & Ground

Symbol	Type	Pin No.	Description
VCC	P	JP1 : 1 , JP2 : 24	Power : 3.3 V power supply for NM7000A
GND	P	JP1 : 8, JP1 : 13, JP1 : 24, JP2 : 1 JP2 : 7, JP2 : 13 JP2 : 14, JP2 : 23	Ground

MCU Interfaces

Symbol	Type	Pin No.	Description
A14~A0	I	JP1 : 7, JP1 : 10 JP1 : 9, JP1 : 12 JP1 : 11 JP1 : 14 ~ JP1 : 23	Address : **15 bit-wide address bus**

D7~D0	I/O	JP2 : 21, JP2 : 22 JP2 : 19, JP2 : 20 JP2 : 17, JP2 : 18 JP2 : 15, JP2 : 16	**Data** : 8 bit-wide data bus
/CS	I	JP1 : 5	**Module Select** : Active low. /CS of W3100A
/RD	I	JP1 : 4	**Read Enable** : Active low. /RD of W3100A
/WR	I	JP1 : 3	**Write Enable** : Active low /WR of W3100A
/INT	O	JP1 : 2	**Interrupt** : Active low Indicates that the W3100A requires MCU attention after reception or transmission. The interrupt is cleared after writing values to the ISR of W3100A (Interrupt Status Register). All interrupts can be masked by writing values to the IMR of W3100A(Interrupt Mask Register).For more details refer to the W3100A Datasheet

Network Interfaces & Network status Indicator LEDs

Symbol	Type	Pin No.	Description
TPTX+	O	JP2 : 3	**Transmit Output** : Differential pair shared

TPTX-		JP2 : 5	by 100 Base TX and 10 Base Modes. When configured as 100 Base TX,
TPRX+	I	JP2 : 9	**Receive Input** : Differential pair shared by 100 Base TX and 10 Base T Modes.
TPRX-		JP2 : 11	
L_COL	O	JP2 : 6	**Collision LED** : Active low when collisions occur.
L_100ACT	O	JP2 : 8	**Link 100/ACT LED** : Active low when linked 100 Base TX, and blinking when transmitting or receiving data.
L_10ACT	O	JP2 : 10	**Link 10/ACT LED** : Active low when linked 10 Base T, and blinking when transmitting or receiving data.
L_LINK	O	JP2 : 12	**Link LED** : Active low when linked

Reset

Symbol	Type	Pin No.	Description
RESET	I	JP1 : 6	**Reset** : Active high Initializes or Reinitializes the W3100A. Asserting this pin will force a reset process to occur, which will result in all internal registers reinitializing to their default and all strapping options are reinitialized. For complete reset function, this pin must be asserted low for at least 10us. Refer to W3100A datasheet for further detail regarding reset.
/RESET	I	JP2 : 2	**Reset :** Active low

			Reset RTL8201BL chip. For complete reset function, this pin must be asserted low for at least 10ms.